

Application Serial No. 10/537,863
Amendment filed December 1, 2008
Reply to final Office Action mailed September 18, 2008

REMARKS

Claims 1-6 are pending and under consideration in this application. Claims 1 and 6 have been amended. Support for the amendments to the claims may be found in the claims as originally filed, and in the specification at page 3, lines 11-17, page 5, lines 10-22, page 6, lines 16-27, page 8, lines 17-37, continuing at page 9, lines 1-23, and page 12, lines 11-20. This amendment is believed to place the application in condition for allowance, and entry therefore is respectfully requested. In the alternative, entry of this amendment is requested as placing the application in better condition for appeal by, at least, reducing the number of issues outstanding. Further reconsideration is requested based on the foregoing amendment and the following remarks.

Response to Arguments:

The Applicants appreciate the consideration given to their arguments. The Applicants, however, are disappointed that their arguments were not found to be persuasive. The final Office Action asserts at the bottom of page 6, that:

Applicant argues the Inagawa does not teach bottom formation of the hole. The examiner respectfully disagrees because Inagawa is directed to a two step process.

In neither of those two steps, however, is Inagawa “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited formerly in claim 1. The first step of Inagawa, rather, is high speed rough boring by thermal processing using a long wavelength laser, which will not “form a via hole with an underlying layer exposed at its bottom,” as recited formerly in claim 1.

The second step of Inagawa, which is an optical chemical processing using a short wavelength laser for smoothing the bore wall, will not “form a via hole with an underlying layer exposed at its bottom” as recited formerly in claim 1, either. Thus, even though the process of Inagawa has two steps, Inagawa is not “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited formerly in claim 1.

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The final Office Action asserts further at the bottom of page 6, and continuing at the top of page 7, that:

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The two cases cited in the final Office Action, *In re Keller*, 642 F. 2d 413, 208 USPQ 871 (CCPA 1981) and *In re Merck & Co.*, 800 F. 2d 1091, 231 USPQ 375 (Fed. Cir. 1986), each dealt with arguments that *one* of the references involved in a combination lacked a particular element. The Applicants arguments, in contrast, are directed against the *combination* of references itself, not the references individually.

The Applicants, in particular, pointed out that *all* the cited references lack, for example, "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," and thus, even if the references were combined, the claimed invention would not result. Thus, the Applicants protested the *combination* of Inagawa with Gaku '913, Gaku '641, Bui, Welsch, Den, or Yaita, not any of the references *individually*, and so neither *Keller* nor *Merck* are at all applicable.

Still, in the interest of compact prosecution only, and not for any reason of patentability, claims 1 and 6 have been amended further to recite, substantially "a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler," and "a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin." Further reconsideration is thus requested.

Claim Rejections - 35 U.S.C. § 102:

Claim 1 was rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 5,166,493 to Inagawa et al. (hereinafter "Inagawa"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

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The claimed invention uses laser beams of different wavelengths selectively with respect to an inorganic filler or a modified layer of resin. The claimed invention thus forms a via hole successfully with a bottom free from residue. The second clause of claim 1, in particular, recites:

Firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer.

Inagawa neither teaches, discloses, nor suggests "firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer," as recited in claim 1. Inagawa, in contrast, forms an opening with two laser beams, and is quite silent about the selective use of laser beams of different wavelengths to expel and remove an inorganic filler. Inagawa, in other words, describes nothing about a relationship between a wavelength of the laser beam and an inorganic filler.

Inagawa, moreover, is quite silent about the use of a laser beam of a specific wavelength for removing resin remaining after expelling the inorganic filler. Nor does Inagawa describe a relationship between a wavelength of a laser beam and a modified layer or resin remaining at the bottom of the hole.

The third clause of claim 1 recites:

Firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom.

Inagawa neither teaches, discloses, nor suggests "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1.

Inagawa, rather, uses a short wavelength laser for smoothing the bore wall. In particular, as described in the Abstract:

A first step of the process is high speed rough boring by thermal processing using a long wavelength laser, and a second step is an optical chemical processing using a short wavelength laser for smoothing the bore wall.

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Since Inagawa uses a short wavelength laser for smoothing the bore wall, Inagawa is not "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1.

Inagawa, in fact, is forming a *through* hole, not a hole with "a modified layer of the resin remaining at the bottom of said hole" as recited in claim 1. In particular, as described further in the Abstract:

A highly reliable through hole can be high speed processed in a short period of time.

Since Inagawa is forming a through hole, Inagawa is not "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1.

Inagawa, moreover, is smoothing the *wall* of a *through* hole by opto-chemical processing using a short wavelength laser, not removing "a modified layer of the resin remaining at the bottom of said hole," as recited in claim 1. In particular, as described at column 2, lines 20-28:

To attain the above first object of the invention, there is provided an apparatus, which can perform a two-step process consisting of a first step of high speed forming a hole by thermal processing using a long wavelength laser and a second step of smoothing the hole wall by opto-chemical processing using a short wavelength laser, thus obtaining a highly reliable through hole having a small diameter and excellent hole wall shape in a short period of time.

Since Inagawa is smoothing the hole wall by opto-chemical processing using a short wavelength laser, Inagawa is not "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1.

Inagawa, moreover, is finishing of the hole *wall* surface to a smooth surface with less irregularities, not removing "a modified layer of the resin remaining at the bottom of said hole," as recited in claim 1. In particular, as described at column 2, lines 36-46:

A second object of the invention is to provide an apparatus, which provides a pulse laser beam output of a short wavelength laser such as an excimer laser for a copper foil circuit pattern part, provides a pulse laser beam output of a long wavelength laser such as a CO₂ laser for a resin part, and further provides alternate pulse laser beam outputs of short and long wavelength lasers for removal of carbide generated in the processing of the resin part, thus permitting finishing of the hole wall surface to a smooth surface with less irregularities.

Since Inagawa is finishing of the hole wall surface to a smooth surface with less irregularities, Inagawa is not “firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

In Inagawa, moreover, the *surface* of the first *through* hole is irradiated with the short wavelength laser beam 4, not “the bottom of said hole,” as recited in claim 1. In particular, as described at column 4, lines 1-4:

In a second step, as shown in FIG. 2(c) the surface of first through hole formed in the first step is irradiated with short wavelength laser beam 4 from short wavelength laser beam generator means (not shown).

Since, in Inagawa, the surface of the first through hole formed in the first step is irradiated with the short wavelength laser beam 4, Inagawa is not “firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

Finally, in Inagawa, the last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface *after* the through hole is formed. There *is* no “bottom of said hole,” as recited in claim 1, *after* the through hole is formed. In particular, as described at column 6, lines 10-13:

After the through hole is formed as shown in FIG. 4(d), last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface.

Since, in Inagawa, the last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface after the through hole is formed, Inagawa is not “firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer

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of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1. Claim 1 is submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

Claim Rejections - 35 U.S.C. § 103:

Claims 2 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Inagawa in view of U.S. Patent Application Publication No. 2003/0049913 to Gaku et al. (hereinafter "Gaku '913"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claim 2 depends from claim 1 and adds further distinguishing elements. Inagawa neither teaches, discloses, nor suggests "firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer," or "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 1. Gaku '913 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 2. Gaku, rather, only describes a type of laser beam and is quite silent about a relationship between a wavelength of the laser beam and the inorganic filler or the modified layer. Thus, even if Inagawa and Gaku '913 were combined as proposed in the final Office Action, claim 2 would not result. Claim 2 is thus submitted to be allowable. Withdrawal of the rejection of claim 2 is earnestly solicited.

Claim 6:

The second clause of claim 6 recites:

Providing an infrared laser beam not absorbed by the inorganic filler.

Inagawa neither teaches, discloses, nor suggests "providing an infrared laser beam not absorbed by the inorganic filler," as discussed above with respect to the rejection of claim 1. Gaku '913 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 6.

The seventh clause of claim 6 recites:

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Providing an ultraviolet laser beam capable of cleaving C-C bonds of the resin.

Inagawa neither teaches, discloses, nor suggests "providing an ultraviolet laser beam capable of cleaving C-C bonds of the resin," as discussed above with respect to the rejection of claim 1. Gaku '913 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 6.

The tenth clause of claim 6 recites:

Exposing an underlying layer at the bottom of the via hole by removing the modified layer of the resin.

Inagawa neither teaches, discloses, nor suggests "exposing an underlying layer at the bottom of the via hole by removing the modified layer of the resin," as discussed above with respect to the rejection of claim 1. Gaku '913 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 6. Thus, even if Inagawa and Gaku '913 were combined as proposed in the final Office Action, claim 6 would not result. Claim 6 is thus submitted to be allowable. Withdrawal of the rejection of claim 6 is earnestly solicited.

Claim 3:

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Inagawa in view of U.S. Patent No. 6,280,641 to Gaku et al. (hereinafter "Gaku '641"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claim 3 depends from claim 1 and adds further distinguishing elements. Inagawa neither teaches, discloses, nor suggests "firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer," or "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 1. Gaku '641 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 3. Thus, even if Inagawa and Gaku '641 were combined as proposed in the final Office Action, claim 3 would not result. Claim 3 is thus submitted to be allowable. Withdrawal of the rejection of claim 3 is earnestly solicited.

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Claim 4:

Claim 4 was rejected under 45 U.S.C. § 103(a) as being unpatentable over Inagawa and Gaku '641 in view of U.S. Patent No. 6,413,820 to Bui (hereinafter "Bui") or U.S. Patent No. 6,226,173 to Welsch et al. (hereinafter "Welsch"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claim 4 depends from claim 1 and adds further distinguishing elements. Neither Inagawa nor Gaku '641 teach, disclose, nor suggest "firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer," or "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 3. Neither Bui nor Welsch do either, and thus cannot make up for the deficiencies of either Inagawa or Gaku '641 with respect to claim 4. Thus, even if Inagawa, Gaku '641, Bui, and Welsch were combined as proposed in the final Office Action, claim 4 would not result. Claim 4 is thus submitted to be allowable. Withdrawal of the rejection of claim 4 is earnestly solicited.

Claim 5:

Claim 5 was rejected under 55 U.S.C. § 103(a) as being unpatentable over Inagawa and Gaku '641 in view of U.S. Patent No. 6,649,824 to Den et al. (hereinafter "Den") or U.S. Patent No. 6,226,173 to Yaita et al. (hereinafter "Yaita"). The rejection is traversed to the extent it might apply to the claims as amended. Reconsideration is earnestly solicited.

Claim 5 depends from claim 1 and adds further distinguishing elements. Neither Inagawa nor Gaku '641 teach, disclose, nor suggest "firing onto the resin layer including the inorganic filler a laser beam of a wavelength within the infrared region and not absorbed by the inorganic filler, at a position of said resin layer for forming a via hole so as to expel the resin and said inorganic filler and thereby form a hole in said resin layer," or "firing a laser beam of a wavelength within the ultraviolet region and capable of cleaving C-C bonds of the resin, focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 3. Neither Den nor Yaita do either, and

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thus cannot make up for the deficiencies of either Inagawa or Gaku '641 with respect to claim 5. Thus, even if Inagawa, Gaku '641, Den, and Yaita were combined as proposed in the final Office Action, claim 5 would not result. Claim 5 is thus submitted to be allowable. Withdrawal of the rejection of claim 5 is earnestly solicited.

Conclusion:

Accordingly, in view of the reasons given above, it is submitted that all of claims 1-6 are allowable over the cited references. Allowance of all claims 1-6 and of this entire application is therefore respectfully requested.

If there are any formal matters remaining after this response, the Examiner is invited to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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